



ARIZONA DEPARTMENT OF TRANSPORTATION

INTERMODAL TRANSPORTATION DIVISION
ENGINEERING CONSULTANTS SECTION
205 South 17th Avenue - Room 293E, Mail Drop 616E
Phoenix, Arizona 85007



JANE DEE HULL
Governor

MARY E. PETERS
Director

July 30, 1998

THOMAS G. SCHMI
State Engineer

Engineering Consultants Section

INFORMATION BULLETIN 98-18

TO: Consultants

FROM: Engineering Consultants Section *For*

SUBJECT: Geotechnical Investigation Procedures - Excavation Factors for Depressed Urban Freeways

The attached memo provides revised procedures for determining excavation factors for depressed urban freeways.

If you have questions regarding this bulletin, please call John Lawson at (602) 255-8130.

attachment

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
MATERIALS GROUP

1221 North 21st Avenue Phoenix, Arizona 85009-3740

OFFICE MEMO

12 June 98

TO: John Lawson
Manager, ADOT Geotechnical Design Section, 068R

FROM: Steve Haire
Geotechnical Design Engineer, 068R

REFERENCE: ADOT Materials
Preliminary Engineering and Design Manual

SUBJECT: **GEOTECHNICAL INVESTIGATION PROCEDURES - EXCAVATION
FACTORS FOR DEPRESSED URBAN FREEWAYS**

The purpose of this memo is to provide revised procedures for determining excavation factors for depressed urban freeways. Section 102.05, page 32, of the referenced manual provides recommendations for determining excavation factors for a typical project. However, these recommendations were not developed for depressed urban freeways.

For determining excavation factors for urban freeways, the following geotechnical investigation procedures are recommended for depressed sections:

- Locate test pits or large diameter test holes at a minimum 900-foot spacing within the excavation prism. In general, this spacing coincides with every third roadway exploration boring/pit that are required on a 300-ft spacing in a cut area, as designated in the referenced manual. The locations of the test pits or large diameter test holes should be adjusted as necessary to ensure coverage of the deeper portions of the excavation zone. The pits or holes must be large enough to conduct in-place density testing at various depths and obtain bulk samples of the same materials for lab proctor testing. For test pits, provide sloped or shored pit walls as necessary for safety.
- Perform a field density test at a minimum every 2.5 feet of depth down to the total depth of excavation. Adjust depths as necessary to accommodate boundaries between strata. Obtain a bulk sample of the material at each density test location for classification and proctor testing. Obtain enough material for a 4-pt. proctor.
- Calculate shrinkage values at every point based on the field density and the 4-pt. proctor values. Some recommended guidelines for the calculations are presented later in this memo.

- Based on the analyses and engineering judgment, present a table of recommended excavation (shrink or swell) factors by station. The values should be rounded to the nearest 5%. For the case of 2 or more layers with a significantly different excavation factor over a given length of the alignment, the factors should be averaged vertically based on the approximate relative volume contribution of the layers.

EXCAVATION FACTOR CALCULATION

The ADOT Roadway Design Section requests excavation factors based on the field excavation volume, as expressed in the following equation:

$$\% \text{ Shrink} = [(V_{\text{ex}} - V_{\text{emb}}) / V_{\text{ex}}] * 100 = [1 - V_{\text{emb}} / V_{\text{ex}}] * 100$$

where V_{ex} = in-place volume to be excavated
 V_{emb} = volume of compacted embankment

Since volume is inversely proportional to dry density, the above equation can be re-written as follows:

$$\% \text{ Shrink} = [1 - \gamma_{\text{ex}} / \gamma_{\text{emb}}] * 100$$

where γ_{ex} = in-place dry density of material to be excavated
 γ_{emb} = dry density of compacted embankment

For ADOT Roadway projects, substitute 95% of the maximum proctor dry density for γ_{emb} .